



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

Nuclear Science User Facilities

**NSUF Overview and Workscopes
FY 2017 Consolidated Innovative Nuclear
Research FOA
DE-FOA-0001515**

**Dr. Rory Kennedy - Director
Dan Ogden - Deputy Director
Idaho National Laboratory**



CINR Webinar
August 9, 2016



- **Welcome (Kennedy)**
- **NSUF-2 workscopes (Kennedy)**
- **Changes from FY 2016 (Ogden)**
- **Overview of NSUF (Ogden)**
- **Requesting NSUF Access (Ogden)**
- **NSUF Questions (Kennedy, Ogden)**

- **Nuclear Science User Facilities proposal call**
 - Integrated into Consolidated Innovative Nuclear Research FOA in FY 2015
 - Allowed for coupling single application with R&D funding
 - All awarded projects fully forward funded since FY 2015
- **Interest and support levels**
 - FY 2014 – \$400K, 8 full proposals, 3 awards
 - FY 2015 – \$4.1M, 41 LOIs, 31 pre-proposals, 17 full proposals, 5 awards (1 R&D coupled, 4 NSUF only))
 - FY 2016 – \$9.7M (\$5.7M in FOA), 80 LOIs, 67 pre-proposals, 32 full proposals, 12 awards (8 R&D coupled, 4 NSUF only)
 - FY 2017 – (~\$6M in FOA)

■ Participate in NSUF activities

- Join the Users Organization
- Attend the Users Meeting
- Contribute to NSUF review meetings
 - DOE-NE Annual Review Meeting
 - NSUF Science Review Board
- Engage communities at NSUF exhibits
 - TopFuel, Boise, ID (Sept. 11 – 16, 2016)
 - ANS Winter Meeting, Las Vegas, NV (Nov. 6 – 10, 2016)
 - NuMat, Montpellier, France (Nov. 7 – 11, 2016)
 - MRS Fall Meeting, Boston, MA (Nov 27 – Dec. 2, 2016)
 - TMS Annual Meeting, San Diego, CA (Feb. 26 – March 2, 2017)



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

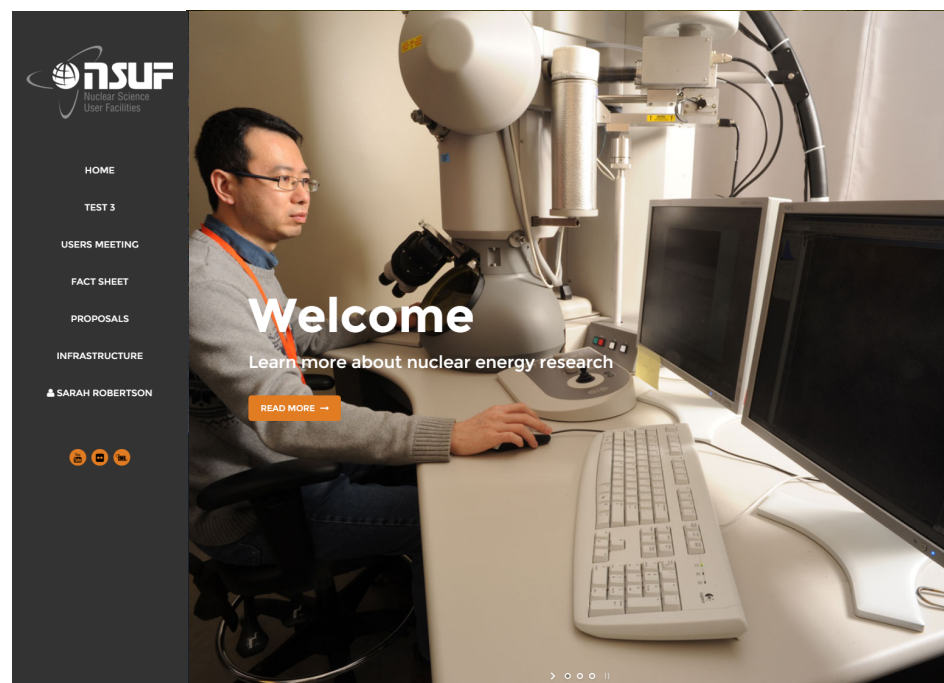
New Website to Launch in FY 2016



Current home page



New home page



- Designed to adapt from desktop computer screen to tablets or mobile devices
- Incorporates single sign-on for proposal system and NEID
- Allows us to better highlight the work we do



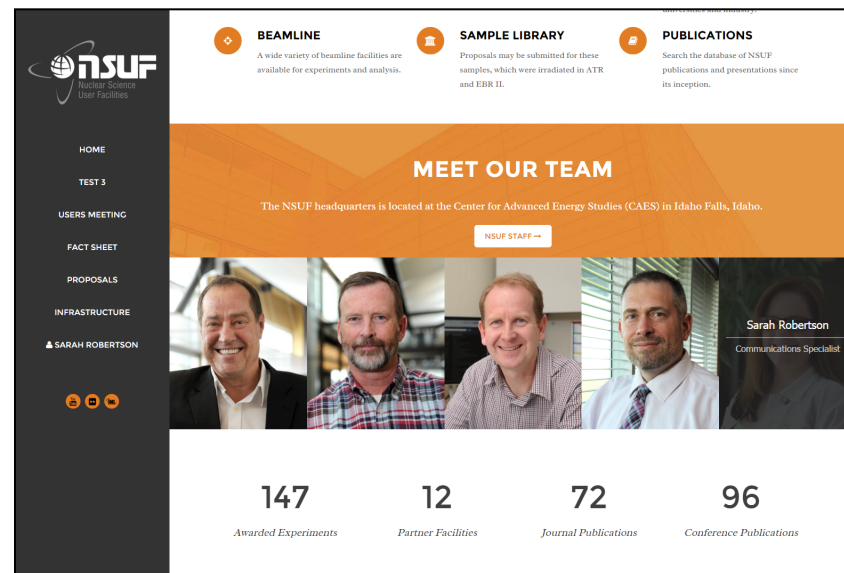
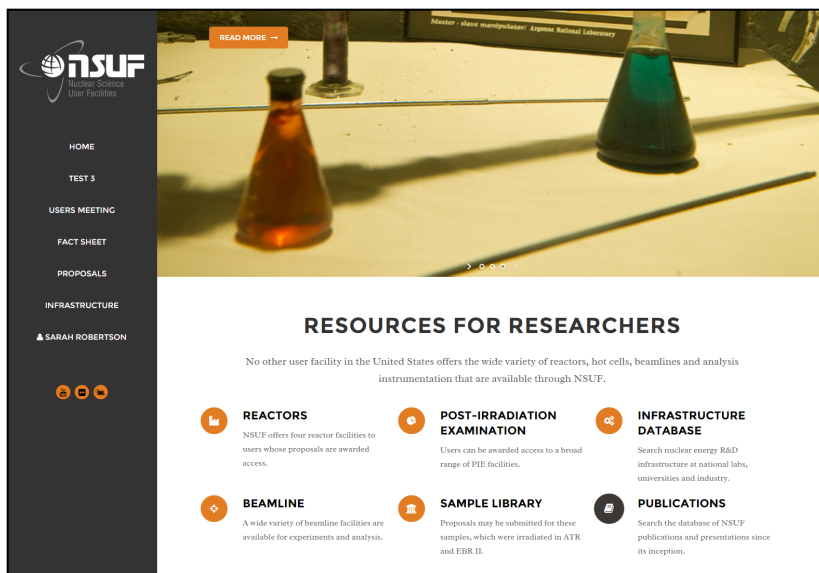
U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

New Website to Launch in FY 2016



■ Scroll down on the home page to access more website areas





■ Objective

- Provide access to the capabilities of the NSUF for research projects supporting the DOE Office of Nuclear Energy mission at no cost to the user

■ Types of Projects

- Irradiation and PIE
- Irradiation only
- PIE only
- Beamline (ion and synchrotron)
- High Performance Computing

■ Restrictions

- R&D support funding not provided
- NSUF does not fund travel, salaries, or other user costs
- Source, scope and duration of R&D funding must be identified
- Preliminary development effort should be complete

-
- **Dropped “NEET” from NSUF workscope titles in FY 2017
CINR FOA (Appendix B)**
 - **Combined experimental and computational projects are encouraged**
 - See relevant helpful information in Appendix D (Data Needs for Validation)
 - **NSUF-1, NEAMS-2 (Appendix A)**
 - Projects coupling R&D funding with NSUF capabilities access
 - R&D funding from NE programs with focused workscope topics
 - Program managers will present workscope descriptions
 - **NSUF-2**
 - Projects requesting only access to NSUF capabilities
 - R&D funding support already established

■ Core and Structural Materials

- Understanding material aging and degradation mechanisms due to irradiation or irradiation combined with other environmental effects
- Development of radiation resistant materials for current and future reactor applications

■ Nuclear Fuel Behavior and Advanced Nuclear Fuel Development

- Increase fundamental understanding of the behavior of nuclear fuel (including cladding)
- Improve performance of current fuels
- Research and develop advanced fuels
- Irradiation and thermal effects on microstructure, thermophysical and thermomechanical properties and chemical interactions
- Projects should aim at proposing irradiation experiments with post irradiation examination investigation of fundamental fuel performance aspects such as radiation damage, species diffusion, and fission product behavior



■ Advanced In-reactor Instrumentation

- Characterization of materials and sensors under irradiation in test reactors
 - Dimensional Changes
 - Crack Propagation
 - Internal Fission Gas Pressure
 - Non-intrusive to the specimen
- On-line condition monitoring of power reactors
- Non-traditional techniques (optical fibers, ultrasonics, wireless transmission)

■ Experiments with Synchrotron Radiation

- MRCAT beamline at APS through the Illinois Institute of Technology
 - X-ray diffraction, X-ray absorption, X-ray fluorescence, 5 μ m spot size fluorescence microscopy
- XPD beamline at NSLS-II through BNL Nuclear Science and Technology Department
- Fundamental aspects of radiation damage



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

NSUF-2 Workscope Focus Areas



■ Contact Information

- Federal Point of Contact: Alison Hahn

Alison.Hahn@nuclear.energy.gov

- Technical Point of Contact: J. Rory Kennedy

Rory.Kennedy@inl.gov

Changes from FY 2016

- **Dropped “NEET” from NSUF workscope titles**
 - NSUF-1: NSUF Access coupled with R&D funds
 - NSUF-2: NSUF Access Only
- **National Synchrotron Light Source II (NSLS-II) X-Ray Powder Diffraction Beamline offered**
 - Agreement with Brookhaven National Laboratory expected prior to October 1, 2016
- **Clarified NSUF Nuclear Fuels and Materials Library Access**
 - Contents are owned by DOE
 - Collaboration with previous PI highly encouraged
 - Permission from previous PI not required



Changes from FY 2016 cont'd



- **Clarified applicant “readiness” for NSUF access**
 - Materials and samples available at time of full application, or
 - Process well established, equipment and resources available on demand such that samples are available five months after initiation (March 1)
 - Pre-irradiation characterization of material is complete
- **Limited PIE phase of all projects to three years in duration**
- **Publication list from prior NSUF access awards required**
 - CINR Awards
 - Pre-CINR Awards
 - Rapid Turnaround Experiment Awards
 - Beamline Awards
- **User Agreement is non-negotiable and acceptance must be indicated in LOI, pre-application, and full proposal or will not be reviewed**
- **Fusion Energy studies are not relevant to NE mission**
- **LOI due date August 29 - Pre application due date September 14**



Reminders



- **Uninvited applications will not be reviewed for NSUF Access**
- **DOE reserving option to decouple R&D request from NSUF Access and evaluate and fund either portion if feasible**
 - Applicable in the NSUF-1 workscope only
- **High Performance Computing Capability access through NSUF**
- **Source, Scope and Duration of R&D support must be identified for NSUF Access Only**
- **LOI due date August 29 - Pre application due date September 14**

What is a User Facility?

Regional, national or international facility with unique experimental capabilities. Access is typically at no cost to the user through a competitive proposal process. The goal is to connect the best ideas with the capability regardless of geographical or institutional separation.



Advanced Photon Source (ANL)



Spallation Neutron Source (ORNL)

There are currently about 50 DOE user facilities in the U.S.

- Advanced scientific computing research
- High flux synchrotron and neutron sources
- Electron beam characterization
- Nano-scale science
- Biological and environmental research
- High energy and nuclear physics
- Fusion energy science

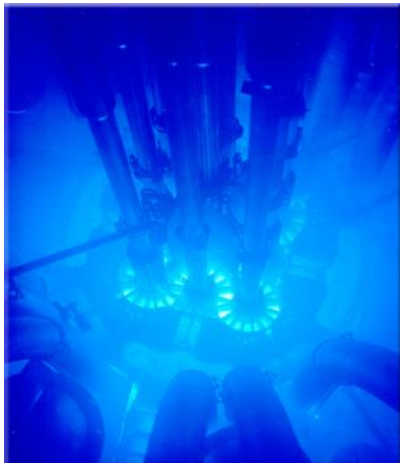
.....But before 2007 there were no user facilities to address the unique challenges of nuclear energy. Then came the Advanced Test Reactor National Scientific User Facility!



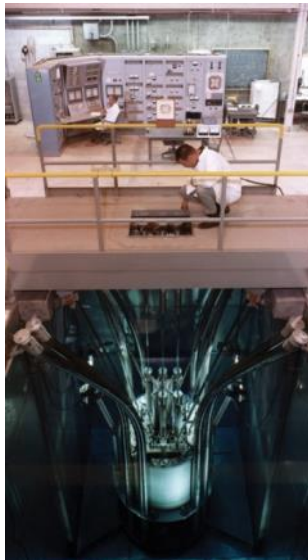
U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

Multiple Test Reactors



Advanced Test Reactor (INL)



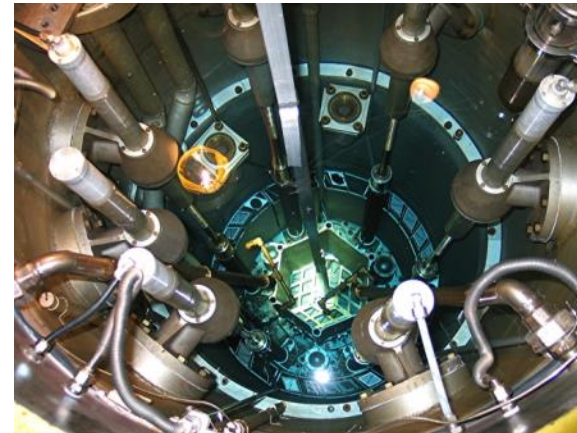
ATR Critical Facility (INL)



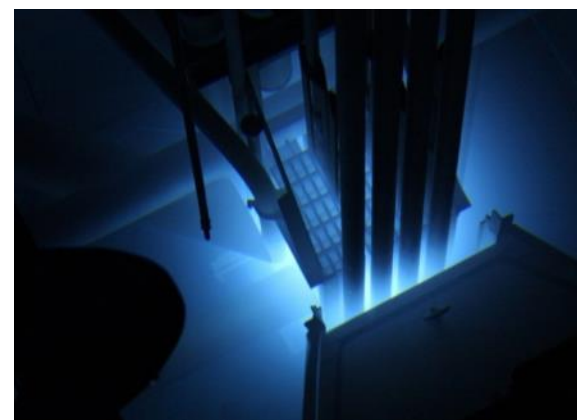
High Flux Isotope Reactor (ORNL)



NRAD Reactor (INL)



MIT Reactor



PULSTAR Reactor
(NCSU)



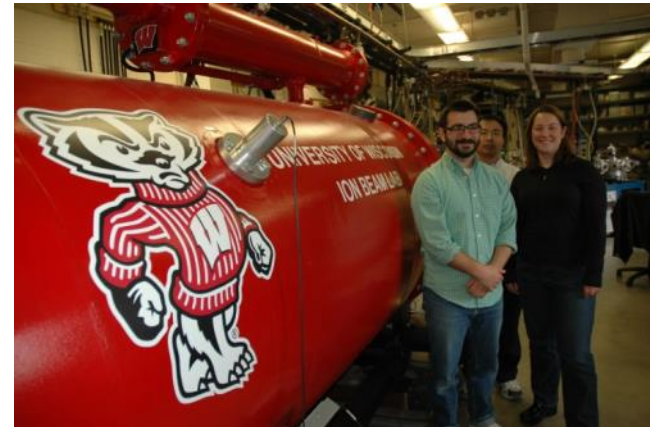
U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

Ion Beams



University of Michigan
Ion Beam Laboratory



University of Wisconsin
Tandem Accelerator Ion Beam



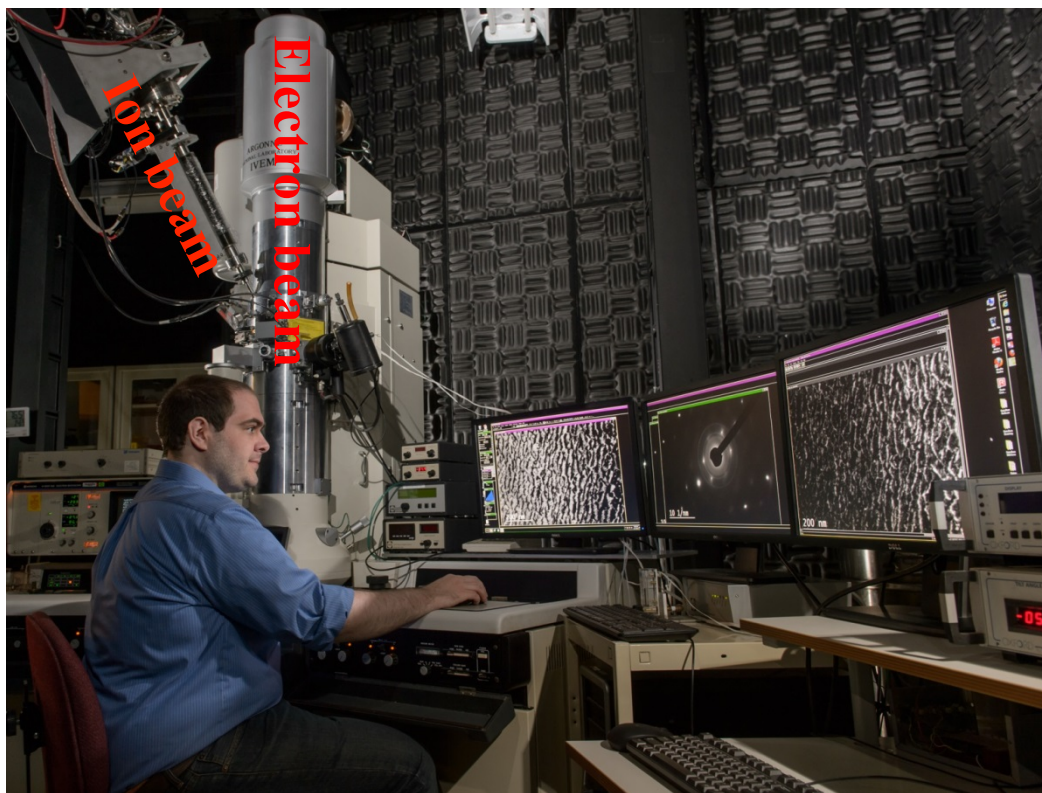
U.S. DEPARTMENT OF
ENERGY

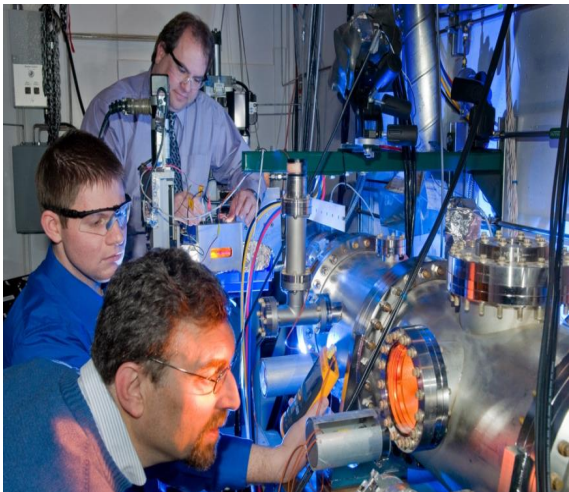
Nuclear Energy

Ion Beams cont'd

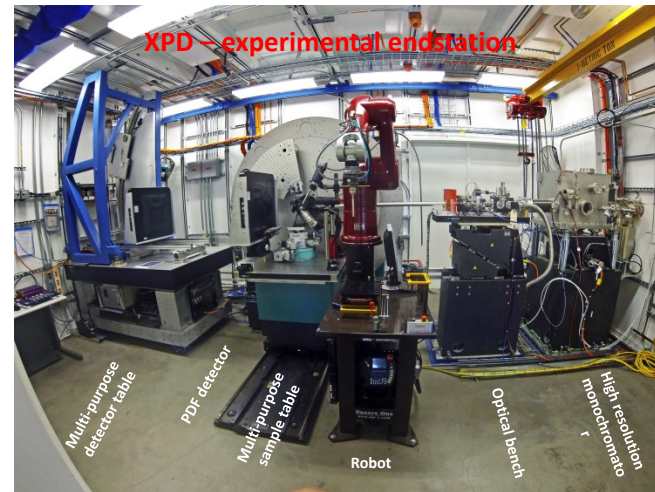


■ Intermediate Voltage Electron Microscope (IVEM)





Illinois Institute of Technology
MRCAT Beamline
at Argonne National Laboratory's
Advanced Photon Source



X-ray Powder Diffraction Beamline
At Brookhaven National Laboratory's
National Synchrotron Light Source II



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

Hot Cell Capabilities



Hot Fuel Examination Facility (INL)



Radiochemical Engineering
Development Center (ORNL)



MIT Reactor Hot Cells



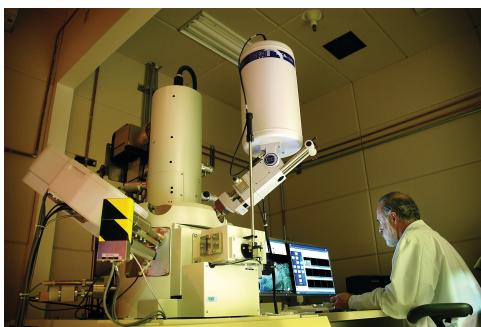
Materials Center of Excellence
Laboratories (Westinghouse)



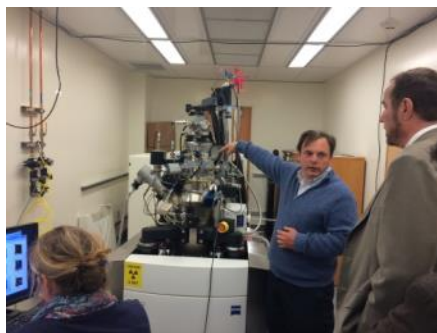
Radiochemistry Processing Laboratory (PNNL)

Post Irradiation Examination

(A sample to whet your appetite – visit nsuf.inl.gov for the full menu)



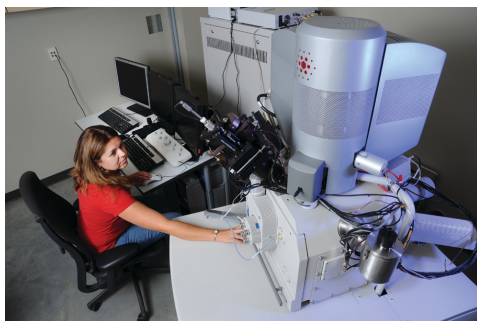
Electron Microscopy Laboratory (INL)



Nuclear Materials Laboratory (UCB)



Radiochemistry Processing Laboratory
Materials Science and Technology Laboratory
(PNNL)



Microscopy and Characterization Suite
Center for Advanced Energy Studies



Low Activation Materials Development
and Analysis Laboratory (ORNL)



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

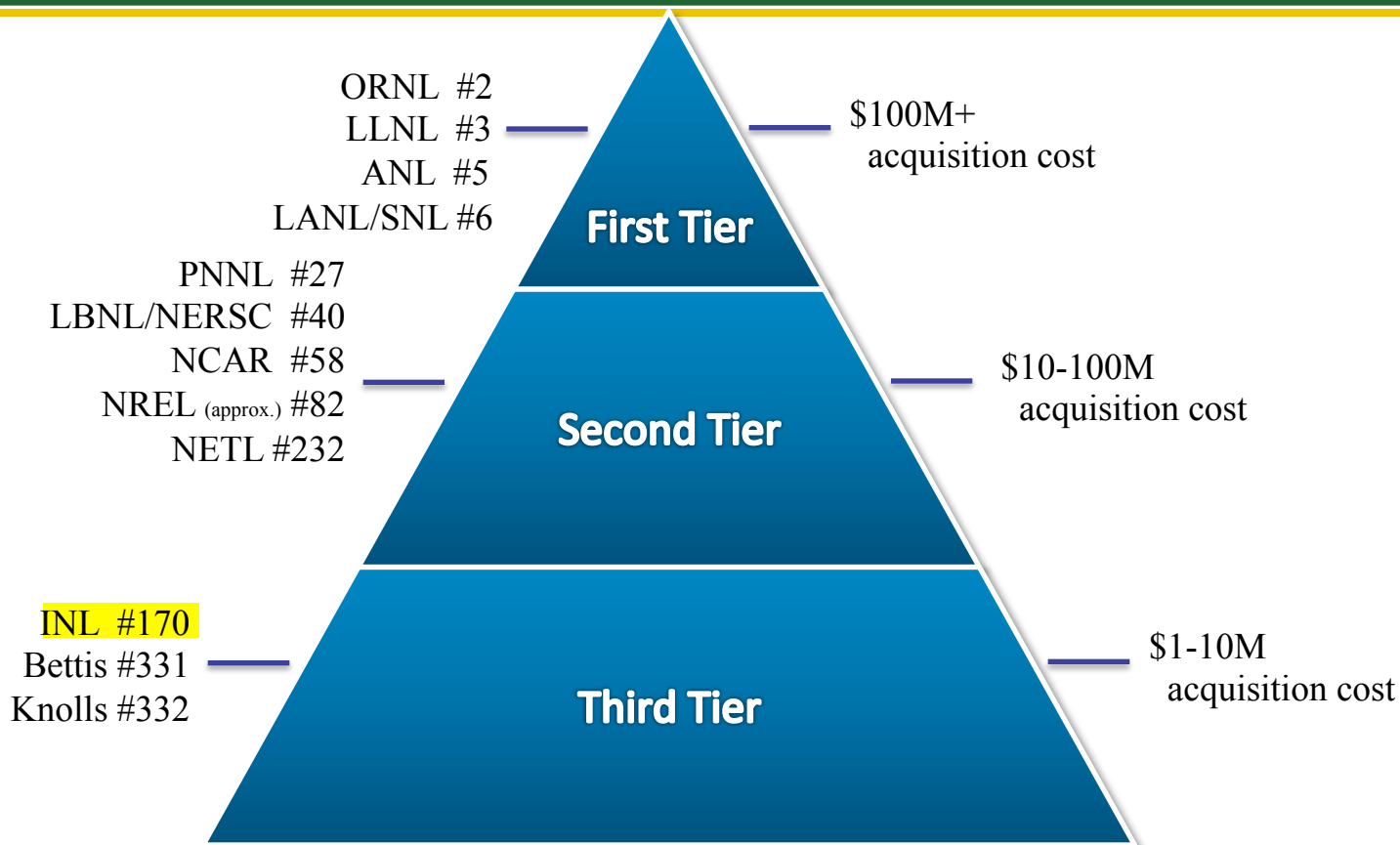
High Performance Computing



MOOSE



Multi-physics Object-Oriented Simulation Environment
www.inl.gov/research/moose-applications



November 2015 Top500 Rankings

INL is strategically positioned in the Third Tier – Supporting the applied science missions of DOE



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

NSUF – A sample of our technical expertise



NSUF Staff (DOE)

Mr. Mike Worley
Ms. Alison Hahn
Mr. Brooks Weingartner

NSUF Staff (INL)

Dr. J. Rory Kennedy
Mr. Dan Ogden
Ms. Lindy Bean
Mr. Jeff Benson
Dr. Brenden Heidrich
Dr. John Jackson
Mr. Collin Knight
Ms. Sarah Robertson
Ms. Kelly Cunningham
Mr. Jonathan Kirkham
Ms. Renae Soelberg
Dr. Sebastien Teyseyre

Neutron Irradiation

Dr. Donna Guillen (INL)
Dr. Paul Murray (INL)
Dr. Lin-wen Hu (MIT)
Dr. Gordon Kohse (MIT)
Dr. Joseph Nielson (INL)
Dr. Randy Nanstad (ORNL)
Dr. Keith Jewell (INL)
Mr. Kevin Clayton (INL)
Mr. Dave Schoonen (INL)
Ms. Debra Utterbeck (INL)
Dr. Sean O'Kelly (INL)
Dr. David Senior (PNNL)
Mr. Mike Heighes (INL)
Mr. Brian Durtschi (INL)

Ion Beams

Dr. Gary Was (UM)
Dr. Beata Tyburska-Puchel (UW)
Dr. Meimei Li (ANL)

Examinations

Dr. Assel Aitkaliyeva (INL)
Dr. Brandon Miller (INL)
Dr. Jian Gan (INL)
Dr. Yaqiao Wu (CAES)
Ms. Joanna Taylor (CAES)
Dr. Andrew Casella (PNNL)
Dr. Kurt Terrani (ORNL)
Dr. Maria Okuniewski (Purdue)
Dr. Peter Hoseman (UCB)
Mr. Ron Crone (INL)
Dr. Mitch Meyer (INL)
Dr. Dan Wachs (INL)
Ms. Katelyn Wachs (INL)
Dr. Jim Cole (INL)

Synchrotron Irradiation

Dr. Jeff Terry (IIT)
Dr. Lynne Eckert (BNL)

And many more scientists, engineers and technical staff to help get things done - you are not alone!

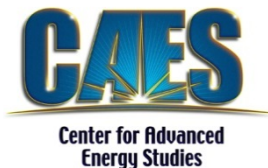


U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

NSUF – A consortium

A group formed to undertake an enterprise beyond the resources of any one member





■ Nuclear Fuels and Materials Library

- A cache of irradiated material with pedigree
- Available for Rapid Turnaround Experiments and full PIE projects
- Contact: Kelly Cunningham, Kelly.Cunningham@inl.gov

■ Nuclear Energy Infrastructure Database (NEID)

- A database capturing the nuclear energy research and development facilities and equipment
- Contact: Jonathan Kirkham, Jonathan.Kirkham@inl.gov

Please visit our website: nsuf.inl.gov

■ Research Menu (A la carte)

- Neutron Irradiation
- Ion Irradiation
- Synchrotron Irradiation
- Post Irradiation Examination

■ Process Drivers

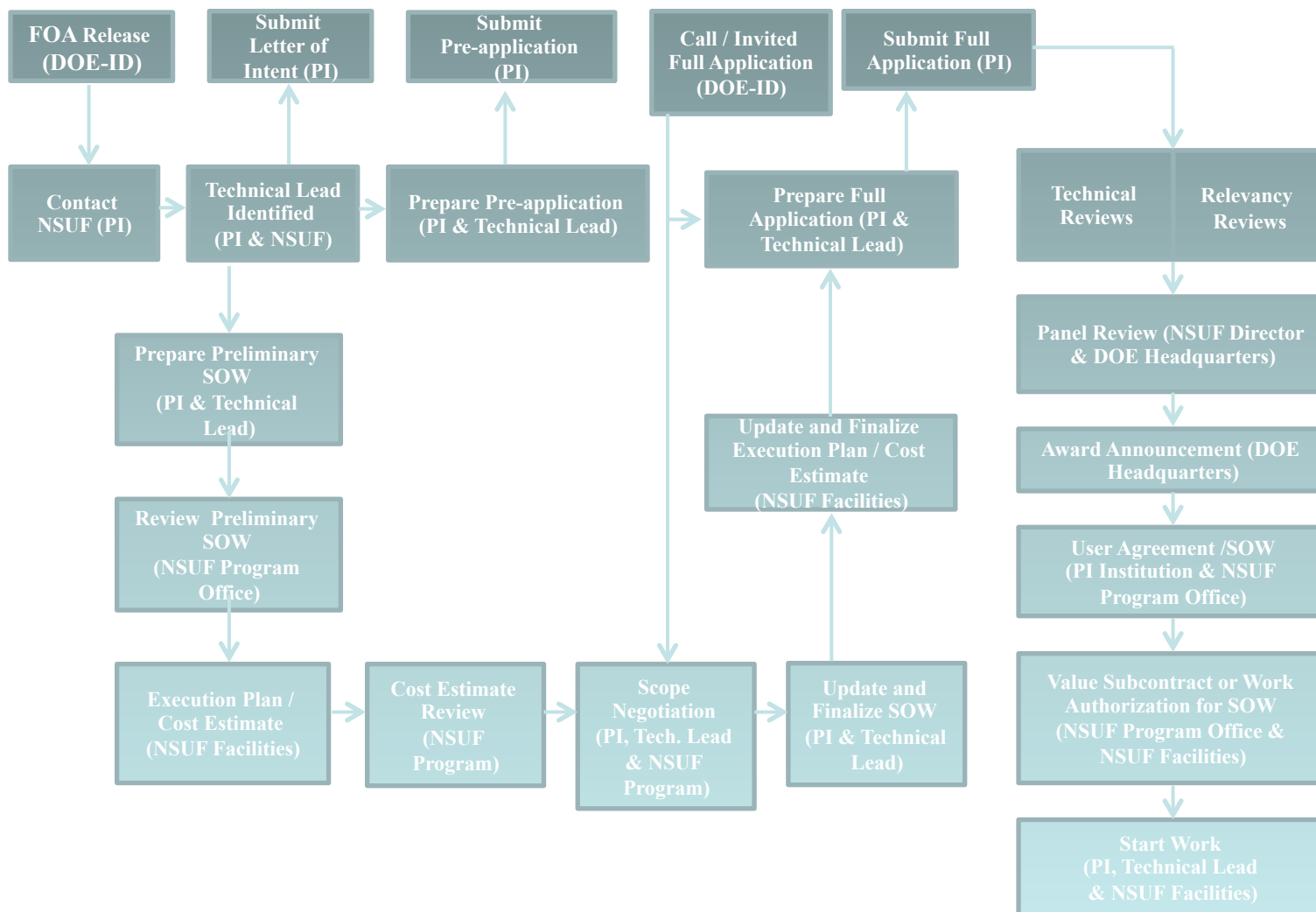
- Request for NSUF access must be feasible
- Determine cost of access (NSUF required to fully forward fund award)
- Applicant will need assistance from NSUF staff

■ Process

- Described in Detail in Appendix E
- Letter of Intent is a critical and mandatory first step (**DUE August 29!**)
- Visit our website at nsuf.inl.gov and contact us soon
- A NSUF Technical Lead will be your new best friend



NSUF Access Process





U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

Questions?



